Model 9645
HV Power Supply

User's Manual

9231584A

ISO 9001
SYSTEM
CERTIFIED

CE

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The information in this document describes the product as accurately as possible, but is subject to change without notice.

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1. Introduction

The Canberra Model 9645 High Voltage Power Supply is a single-width NIM family member of the ICB line of programmable front end electronics and has been designed primarily for operation with semiconductor detectors. It is particularly well suited for use with high resolution detector systems. By design, the 9645 will accommodate all types of detectors requiring up to 6 kV bias and up to 300 μA of current.

The 9645 allows the user to select from two outputs, one ranging from ±30 to ±6000 V dc and the other derived from the first but attenuated by a factor of 10 giving ±3 to ±600 V dc. A 20 segment bar graph displays the output voltage. In addition, this unit allows the user to select the output voltage polarity with an internal control.

The 9645 can withstand any overload or short circuit for an indefinite period of time. The unit can be programmed to either resume normal operations after removal of the fault or to require a programmed reset command.

An INHIBIT input is available for remote shutdown of the 9645. The unit can be programmed to either resume operation upon removal of the INHIBIT signal or to require a programmed reset command.

The 9645's ramp up/down characteristic is a linear function having a time constant of approximately 100 volts per second. When the application software instructs the 9645 to shut off, the 9645's hardware shut off is delayed to allow a controlled output voltage ramp down. The output voltage will ramp down linearly at 100 volts per second. The power supply will shut off a short time after the output voltage reaches zero. If the output voltage is set to zero volts before the supply is shut off, the 9645 will be kept on for approximately 90 seconds to allow for the maximum ramp down time.

The 9645 accepts programming information over an 8-bit wide Canberra bus standard called the Instrument Control Bus (ICB). ICB NIMs connect to this bus via a host module such as the Model 556 Acquisition Interface Module (AIM) as part of a hierarchy of networked acquisition and control managed by a Genie family computing platform.

Adjustments are made via the Graphical User Interface of the Genie software environment. Equivalent batch procedure commands are also available in the environments. All ICB NIM parameters are stored in the single data file structure of the Genie Family, allowing verification of correct setup from one experiment to the next.

All ICB NIMs feature a characteristic bi-color READY LED to indicate operational status.

2. Controls and Connectors

This is a brief description of the front panel controls and connectors. For more detailed information, refer to Appendix A, Specifications.

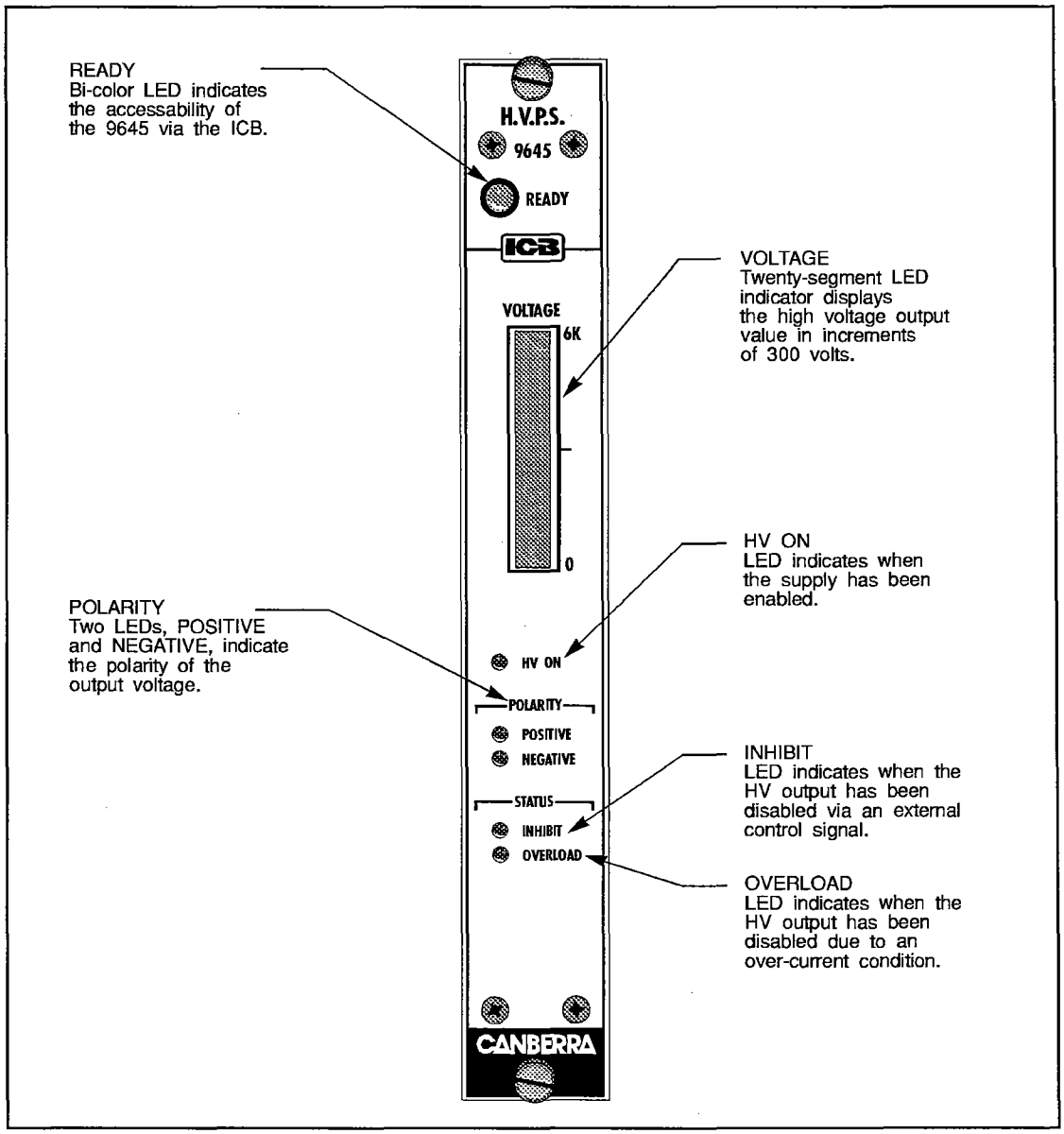


Figure 1 Front Panel Controls

This is a brief description of the rear panel connectors. For more detailed information, refer to Appendix A, Specifications.

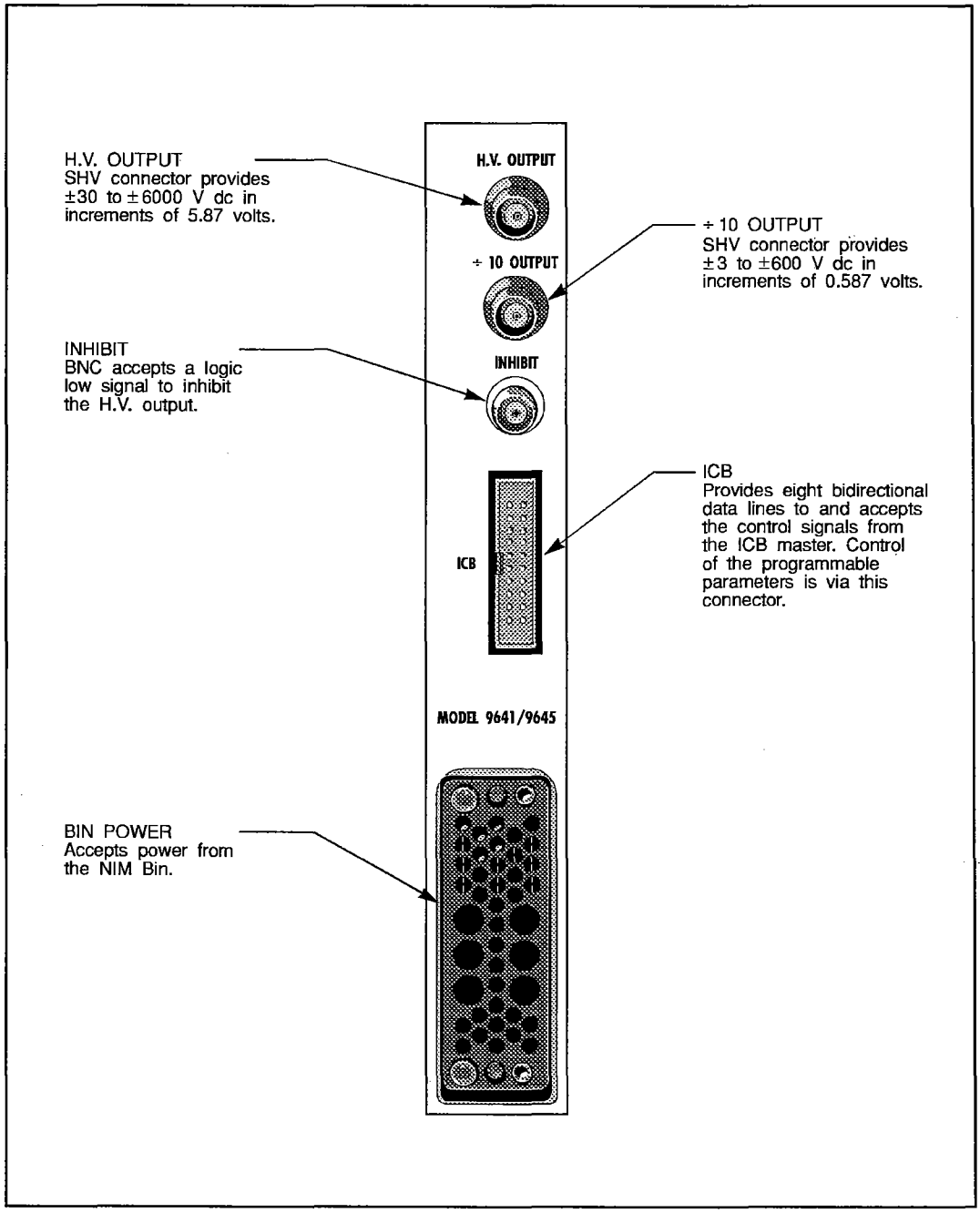


Figure 2 Rear Panel Controls

This is a brief description of the internal controls. For more detailed information, refer to Appendix A, Specifications.

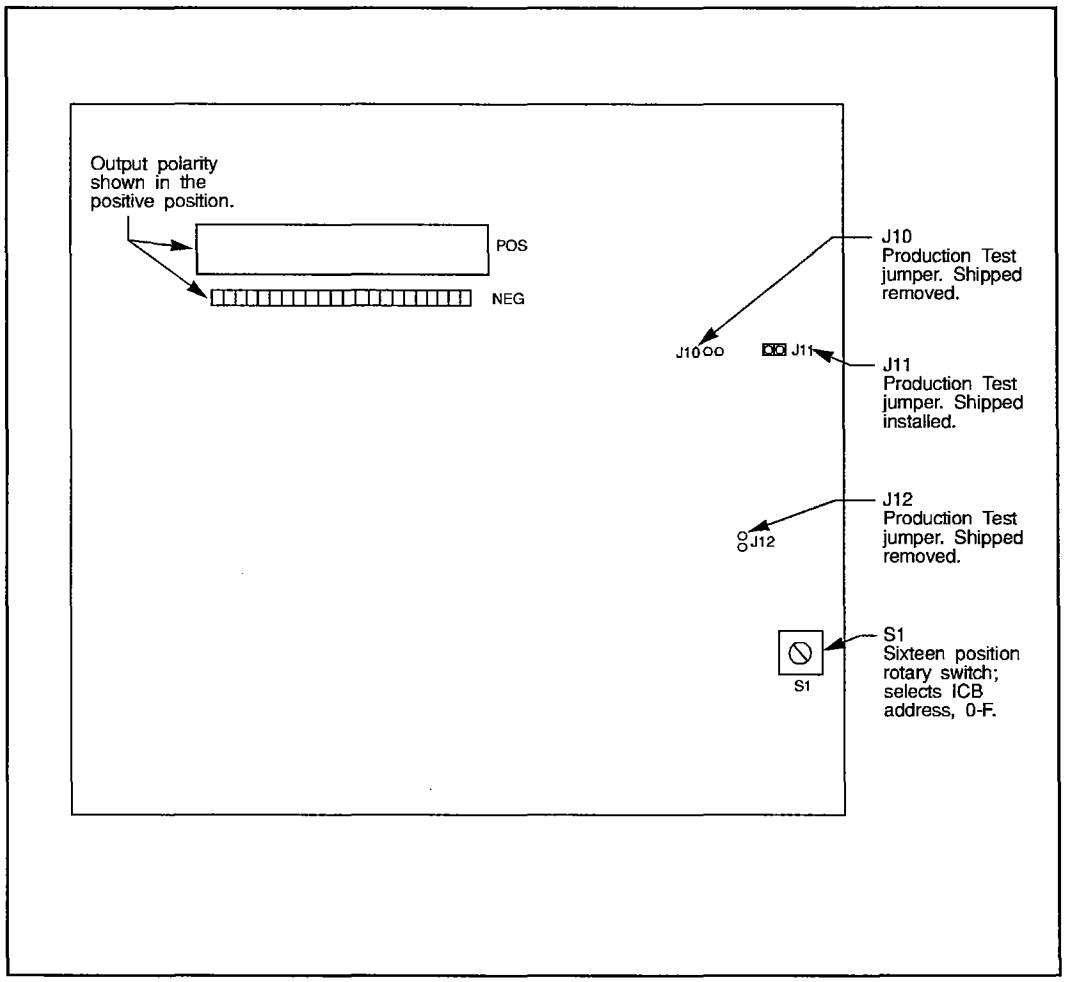


Figure 3 Internal Controls

3. Operation

This section discusses the use of the Model 9645's controls and functions. The controls are programmable unless otherwise noted. For proper operation, an ICB master, such as a Model 556 AIM module, and appropriate software, such as Genie-PC, are required. For details on programming the 9645's controls, please refer to the software manual. The Model 9601 AIM/ICB Setup Manual gives complete instructions for setting up an ICB hardware system.

The 9645 is factory set for positive output polarity. If negative polarity is required, change the internal polarity board before installing the unit in the NIM bin (Section 3.1).

Installation

The Canberra Model 2100 Bin and Power Supply, or other bin and power supply systems conforming to the mechanical and electrical standards set by DOE/ER-00457T will accommodate the Model 9645. The 9645's right side cover acts as a guide for insertion of the instrument. The module is secured by turning the two front panel captive screws clockwise until finger tight. It is recommended that the NIM bin power switch be OFF whenever the module is installed or removed. To ensure safety, be sure to use a NIM Bin which complies with all applicable safety requirements.

The Model 9645 can be operated where the ambient air temperature is between 0°C and +50°C (+120°F maximum). Perforations in the top and bottom sides permit cooling air to circulate through the module. When relay rack mounted along with other heat generating equipment, adequate clearance should be provided to allow for sufficient air flow through both the perforated top and bottom covers of the NIM bin.

Internal Controls

Before removing the unit from the NIM bin, set the VOLTAGE control to 0.00 volts and the HV to OFF.

WARNING The Model 9645 generates hazardous high voltage, which may be present for up to one minute after power is removed from the unit.

Avoid the risk of injury. *Do not remove covers* for at least one minute after power has been removed from the unit.

Polarity Selection

Output polarity can be changed by removing the unit's left side cover and changing the polarity selector board's location. The board is symmetrical by design. Polarity is not affected by orientation. When the unit's NIM bin power is turned on, the front panel POLARITY preview LEDs will indicate the current polarity selection. Canberra recommends that the polarity selection be verified before turning on the unit's NIM bin power. Factory set to POSitive.

WARNING Do not operate the unit without side covers. Always replace the covers immediately after setting the polarity.

ICB Address Selection

The 9645's ICB address is set using a 16-position PC mounted rotary switch. This switch is accessed through a hole in the left side cover. Using a small screwdriver, set the address to a value of 0-F but unique from other modules connected to the Instrument Control Bus (ICB).

Programmable Controls

A majority of the 9645's controls are programmable. For proper operation, an ICB Master and software (AIM and Genie PC for example) are required. Please refer to the software manual for details on controlling the 9645.

Inhibit Control

The Inhibit Function, which is independent of the Voltage Control's setting, allows the output voltage to be conditionally turned off or latched off by grounding or by applying a logic 0 (≤0.7 V) to the rear panel INHIBIT connector. The front panel INHIBIT STATUS indicator lights when the output has been inhibited.

The programmable INHIBIT input is compatible with all Canberra preamps for either selection in the software setup menu; it isn't necessary to select the signal range to match the HV INHIBIT logic high level of the associated Canberra preamp.

The software selection is provided for compatibility with INHIBIT signals from instruments made by other manufacturers. Selecting 5V sets the pull up/clamp level to +5 volts. Selecting 12V sets the pull up/clamp level to +12 volts. Please consult the manual provided with your instrument for its requirements.

The 9645 can also be programmed for the Latched Inhibit Mode or the Conditional Inhibit Mode.

In the Latched Mode a reset is required when a logic 1 or open circuit is present at the INHIBIT connector to restore the output voltage. The reset is generated by way of the software platform. In the Conditional Mode, an INHIBIT input of ≥2 V or an open circuit enables the output.

Automatic Overload Shutdown

One of the 9645's circuits monitors the output load current and automatically disables the outputs for an overload or a fault condition.

A short duration arc-over or turn-on charging transient will not cause shutdown. The front panel OVERLOAD STATUS indicator lights when the unit has been shut down.

The unit can be programmed to either automatically resume operation when the fault is removed or to require a manual reset by way of the software platform.

High Voltage Output

The High Voltage setting is programmable. It can be controlled to 1 part in 1024: 5.86 V (0.586 on the ÷10 output). Enabling and disabling of the HV output is also programmable. When the HV is enabled the front panel HV ON indicator will be illuminated.

Setup

After setting the internal controls, install the Model 9645 in the NIM bin. Connect the load to the appropriate rear panel SHV connector, and connect the ICB Master to the the ICB connector. Set the NIM bin power to ON; the appropriate polarity LED should light, indicating the polarity selected.

Using the appropriate software set the HV to ON and the VOLTAGE control to the desired setting. The front panel bar graph will indicate the HV Output voltage in kilovolts (kV).

Using the 9645 with Genie-PC

When using the Model 9645 with the Model S400 Genie-PC Basic Spectroscopy Software, if power to the NIM Bin containing the Model 9645 is interrupted, the Genie-PC's Idle menu selection will change color, indicating a hardware failure.

Following this hardware failure, further attempts to turn the power supply on using the Adjust function will cause an Error Message. The proper procedure is to first either use "Update" in the Status screen, or, in the Adjust screen, to slightly change the voltage setting. You may then turn the supply *on*.

Connectors

The 9645 has four connectors on the rear panel: HV Output and ÷10 Output, Inhibit, and ICB.

HV Output and ÷10 Output

The 9645 has two rear panel output SHV connectors: HV OUTPUT and ÷10 OUTPUT. Canberra recommends that **only one** of these outputs be used at a time.

For detectors operating at relatively low bias voltages and requiring little current, the ÷10 output should be used. This output is provided by means of a simple voltage divider network, which has an impedance of 20 megohms. Therefore, loading effects have to be taken into account if there is a significant current drain.

The advantage of the ÷10 Output is that the zero offset and the control are better by a factor of 10 over that of the HV OUTPUT. Most detectors (for example, Canberra PIPS detectors, Si(Li) detectors, and Low Energy (LEGe) detectors), take very little current and are thus compatible with the ÷10 Output. The ÷10 Output should never be used with scintillation detectors which draw relatively large currents.

Inhibit Connector

This input allows an external control signal to enable/disable the HV output. A logic low will disable the output.

ICB Connector

This connector provides bidirectional data to, and accepts control signals from, the ICB Master. Control of the 9645 is via this port.

Preventive Maintenance

Preventive maintenance is not required for this unit.

When needed, the front panel of the unit may be cleaned. Remove power from the unit before cleaning. Use only a soft cloth dampened with warm water and make sure the unit is fully dry before restoring power. Because of access holes in the NIM wrap, DO NOT use any liquids to clean the wrap, side or rear panels.

4. Circuit Description

A functional schematic of the Model 9645 can be ordered from Canberra. The high voltage module is basically a dc to dc converter which converts low voltage dc power to a high voltage dc output. This output voltage is highly regulated and filtered, and can be varied by programming the control DAC. The input to the high voltage dc to dc converter is obtained from a conventional NIM power supply and uses ±12 V dc and ±24 V dc. The +5 V for the internal logic is derived from the +6 V NIM Supply.

An oscillator determines a high frequency (≈37 kHz) at which all amplification, high voltage transformation, rectification, and filtering occurs. The amplification is a function of a control voltage which performs the functions of control and regulation. A sample of the output voltage is compared with a reference voltage in the sensing circuit. The sensing circuit generates the control voltage to set and maintain a fixed high voltage output.

A. Specifications

Inputs

INHIBIT – Logic low or ground inhibits the HV outputs; max logic low ≤0.7 V; logic high ≥2.0 V or open circuit enables.

ICB – Provides for connection to the Instrument Control Bus. Control of the Model 9645 is through this interface.

Outputs

HV OUTPUT – ±30 to ±6000 V dc, programmable in 5.87 V increments; 300 µA output current capability; rear panel SHV connector.

÷10 OUTPUT – ±3 to ±600 V dc, adjustable in 0.587 volt increments; Z_{out} = 20 MΩ; rear panel SHV connector.

ICB – Provides feedback on the 9645's status; Inhibit, Overload, Polarity, ON/OFF and HV setting.

Manual Controls

ADDRESS – Rotary switch selects 1 of 16 unique ICB Addresses; accessible through opening in the side cover.

POLARITY – Internal programming plug sets output polarity.

Icb Programmable

ON-OFF – Enable or disable the HV Output.

HV RESET – Restores normal operation following a latched Inhibit and/or Overload Fault condition.

VOLTAGE – Programmable in increments of 5.87 V (0.587 V for the ÷10 output).

MODE CONTROL – Selects latched or non-latched modes for the Inhibit and/or Overload conditions.

Front Panel Indicators

READY – Bi-color LED; green when on-line; yellow for fault or error; off when the module is waiting for the computer to recognize it.

HV OUTPUT – 20 segment Bar graph, 0-6 kV

POLARITY – Front panel LEDs indicate polarity continuously.

INHIBIT – LED to indicate Inhibit status.

OVERLOAD – LED to indicate Overload status.

Performance

RIPPLE AND NOISE – ≤3 mV peak to peak at 300 µA.

OUTPUT STABILITY – Long term drift of output voltage is ≤0.01%/hr. and ≤0.02%/8 hr. at constant input line voltage, load, and ambient temperature after a 30 minute warmup.

TEMPERATURE COEFFICIENT – ≤±40ppm/°C after 30 minute warmup, operating range 0 to 50 °C.

REGULATION – ≤0.001% variation in output voltage over the load range and ≤0.001% for ±0.1% input voltage change within the operating range at constant ambient temperature.

OVERLOAD PROTECTION – Power supply will withstand any overload, including a short circuit for an indefinite period.

CURRENT LIMIT – 450 µA maximum

RESOLUTION – 5.87 V increments (0.587 V for the ÷10 output).

Connectors

HV OUTPUT – Rear panel SHV

÷10 OUTPUT – Rear panel SHV

INHIBIT – Rear panel BNC

ICB – Rear panel 20-pin ribbon header.

ICB Programming Summary

Setup Parameters	Read	Write
Output Voltage	X	X
Voltage Polarity	X	
Inhibit Logic Levels	X	X
Latch Inhibit Mode	X	X
Latch Overload Mode	X	X
Module Status		
ICB Address	X	
Model Number	X	
Factory Serial Number	X	
Hardware Fault	X	
Inhibit Condition	X	
Overload Condition	X	
Control		
On-Line (READY LED – Green)	X	X
Off-Line (READY LED – Off)	X	X
Problem (READY LED – Yellow)	X	X
Inhibit/Overload Reset		X

Power Requirements

+24 V – 15 mA +12 V – 85 mA

–24 V – 10 mA –12 V – 80 mA

+6 V – 350 mA

Physical

SIZE – Standard single width NIM module 3.43 x 22.12 cm (1.35 x 8.71 in.) per DOE/ER-0457T

NET WEIGHT – 1.02 kg (2.25 lb)

SHIPPING WEIGHT – 1.93 kg (4.25 lb)

Environmental

OPERATING TEMPERATURE – 0 to 50 °C.

OPERATING HUMIDITY – 0-80% relative, non-condensing.

Tested to the environmental conditions specified by EN 61010, Installation Category I, Pollution Degree 2.

Cables

A 12-port connecting cable is supplied with each Model 556 AIM; if the cable is ordered separately, specify Model C1560 12-port ICB Connecting Cable.

B. Installation Considerations

This unit complies with all applicable European Union requirements.

Compliance testing was performed with application configurations commonly used for this module; i.e. a CE compliant NIM Bin and Power Supply with additional CE compliant application-specific NIM were racked in a floor cabinet to support the module under test.

During the design and assembly of the module, reasonable precautions were taken by the manufacturer to minimize the effects of RFI and EMC on the system. However, care should be taken to maintain full compliance. These considerations include:

- A rack or tabletop enclosure fully closed on all sides with rear door access
- Single point external cable access
- Blank panels to cover open front panel Bin area
- Compliant grounding and safety precautions for any internal power distribution
- The use of CE compliant accessories such as fans, UPS, etc.

Any repairs or maintenance should be performed by a qualified Canberra service representative. Failure to use exact replacement components, or failure to reassemble the unit as delivered, may affect the unit's compliance with the specified EU requirements.

C. Rear Panel Connectors

This section lists the details of the 9645's rear panel connector.

HV Output

SHV connector supplies 0 to 6000 volts adjustable in increments of 5.86 volts.

÷10 Output

SHV connector supplies 0 to 600 volts adjustable in increments of 0.586 volts.

Inhibit

BNC connector, input accepts an externally generated signal to enable/disable the HV output. A logic low (≤0.7 volts) will disable the HV Output. The maximum high level is programmable with selections of +5 V or +12 V. A high level or open circuit will enable the HV output.

ICB Interface Connector

This 20-pin ribbon connector (J103) provides all the necessary signals for connection to the Instrument Control Bus (ICB). Negative true signals are shown with a trailing asterisk (LWE*); all other signals are positive true.

PIN	SIGNAL	PIN	SIGNAL
1	GND	2	LD0
3	LD1	4	GND
5	LD2	6	LD3
7	GND	8	LD4
9	LD5	10	GND
11	LD6	12	LD7
13	GND	14	LWE*
15	GND	16	LDS*
17	GND	18	LAS*
19	GND	20	LSRQ*

Interface Signal Functions

This section describes the function of each interface signal in detail. All input and output signals are TTL compatable. Unless otherwise noted, the input signal levels are:

Low = 0 to 1.0 volts
High = 2.0 to 5.0 volts

And the output signal levels are:

Low = 0 to 0.5 volts
High = 3.0 to 5.0 volts

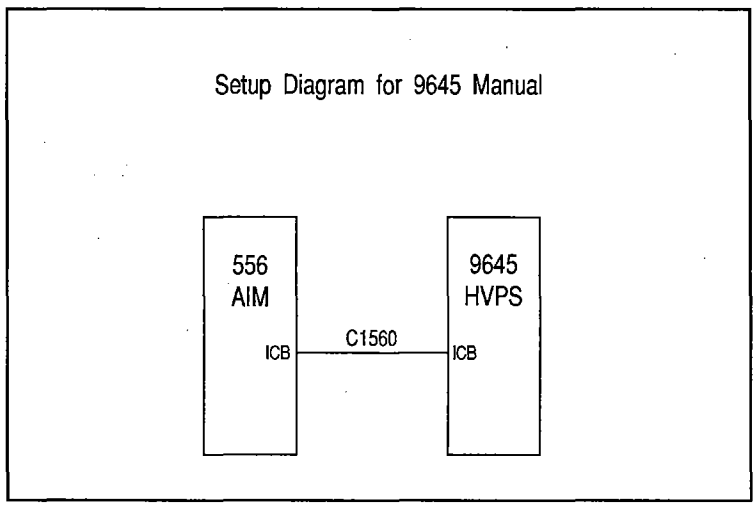
All input and output signals considered to be a logic 1 for a high voltage level unless the signal name is followed by an asterisk (*), in which case the signal is considered to be a logic 1 for a low voltage level.

SIGNAL	PIN	DESCRIPTION
LD0	2	INPUT/OUTPUT: Address/Data line 0 (LSB).
LD1	3	INPUT/OUTPUT: Address/Data line 1.
LD2	5	INPUT/OUTPUT: Address/Data line 2.

LD3	6	INPUT/OUTPUT: Address/Data line 3.
LD4	8	INPUT/OUTPUT: Address/Data line 4.
LD5	9	INPUT/OUTPUT: Address/Data line 5.
LD6	11	INPUT/OUTPUT: Address/Data line 6.
LD7	12	INPUT/OUTPUT: Address/Data line 7. (MSB)
LWE*	14	INPUT (Write Enable): This signal is active when the ICB master is writing to the ICB.
LDS*	16	INPUT (Data Strobe): Used to latch the data into a slave during a write cycle or gate the data onto the bus during a read cycle.
LAS*	18	INPUT (Address Strobe): Used to latch the address which the ICB master is accessing into the slave unit.
LSRQ*	20	OUTPUT (System Request): This signal is set when the slave requires service from the ICB master.
GND	1, 4, 7, 10, 13, 15, 17, 19	DC common for all interface signals.

D. Setup Diagravm

This block diagrams is included to help you set up your system.



Warranty

Canberra (we, us, our) warrants to the customer (you, your) that for a period of ninety (90) days from the date of shipment, software provided by us in connection with equipment manufactured by us shall operate in accordance with applicable specifications when used with equipment manufactured by us and that the media on which the software is provided shall be free from defects. We also warrant that (A) equipment manufactured by us shall be free from defects in materials and workmanship for a period of one (1) year from the date of shipment of such equipment, and (B) services performed by us in connection with such equipment, such as site supervision and installation services relating to the equipment, shall be free from defects for a period of one (1) year from the date of performance of such services.

If defects in materials or workmanship are discovered within the applicable warranty period as set forth above, we shall, at our option and cost, (A) in the case of defective software or equipment, either repair or replace the software or equipment, or (B) in the case of defective services, reperform such services.

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Our warranty does not cover damage to equipment which has been altered or modified without our written permission or damage which has been caused by abuse, misuse, accident, neglect or unusual physical or electrical stress, as determined by our Service Personnel.

We are under no obligation to provide warranty service if adjustment or repair is required because of damage caused by other than ordinary use or if the equipment is serviced or repaired, or if an attempt is made to service or repair the equipment, by other than our Service Personnel without our prior approval.

Our warranty does not cover detector damage due to neutrons or heavy charged particles. Failure of beryllium, carbon composite, or polymer windows, or of windowless detectors caused by physical or chemical damage from the environment is not covered by warranty.

We are not responsible for damage sustained in transit. You should examine shipments upon receipt for evidence of damage caused in transit. If damage is found, notify us and the carrier immediately. Keep all packages, materials and documents, including the freight bill, invoice and packing list.

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